

Joint Acute Toxicity of Esfenvalerate and Diazinon to Fathead Minnow (*Pimephales Promelas*) Larvae

Authors: Debra L. Denton¹, Craig E. Wheelock², Shauna Murray³, Linda A. Deanovic³, Bruce D. Hammock², David E. Hinton⁴

Key Words: diazinon, esfenvalerate, chemical interactions, synergistic effects

California agriculture employs pyrethroid and organophosphate insecticides to control insects in orchards and other crops. Diazinon and esfenvalerate were selected for this study due to their application overlaps. Toxicological and biochemical responses of fathead minnow larvae, *Pimephales promelas*, exposed singly and in combinations to esfenvalerate and diazinon were determined. Exposures were 96 h static-renewal tests using standard Environmental Protection Agency (USEPA) acute toxicity test methods. Following pesticide exposures, larvae were evaluated for carboxylesterase and acetylcholinesterase activity, and histopathological effects. Carboxylesterase activity was examined due to its potential to play an important role in mediating the toxicity of both organophosphates and pyrethroids. *In vivo* studies demonstrated that diazinon significantly inhibited carboxylesterase activity at nominal water concentrations as low as 50 µg/L. However esfenvalerate did not affect carboxylesterase activity at any concentration tested. Liver glycogen depletion, the only histopathological effect observed, was demonstrated with the individual pesticides and pesticide combinations (i.e., mixtures). The combinations of diazinon and esfenvalerate caused acute toxicity to fathead minnow larvae and appeared to be slightly more than additive (i.e., synergistic) in all three tests. Potential pesticide interactions must be addressed when developing total maximum daily loads (TMDLs) for diazinon.

Contact Information: ¹U.S. Environmental Protection Agency
Region IX
Sacramento, CA 95814

²Department of Entomology and Cancer Research Center
University of California
Davis, CA 95616

³Department of Anatomy, Physiology, and Cell Biology
University of California
Davis, CA 95616

⁴Nicholas School of the Environment
Duke University
Durham, NC 27708